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GENOTYPtC AND PHENOTYPIC CORRELATIONS AMONG YIELD AND ITS COMPONENTS IN BLACK PEPPER *(PIPER NIGRUM* L.)

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The relationship between various plant characters has been of interest to plant breeders. Knowledge on such association between various pairs of component characters as well as component characters and yield will render the crop improvement programmes more efficient. The present study is aimed at revealing the genotypic and phenotypic correfation between various pairs of quantitative characters in pepper and their relevance to selection.

Materials and Methods

Data on characters namely spike number, spike length, number of berries per spike, 100 berry weight and spike yield recorded for 28 open pollinated and hybrid lines of pepper raised as seedlings at the Pepper Research Station, Panniyur during the seasons 1981-82, 1982-83 and 1983-84 formed the basic material for this investigation. Number of berries per spike refers to the number of developed berries per spike and spike yield to the weight of green spikes. Spike length and number of berries per spike were recorded as an average from 50 spikes in each plant. The data on the genotypes recorded over different seasons had been treated as two-way classified data and analyses of variance and covariance were done as in a randomised block design wherein treatments were replicated over seasons instead of blocks.

Genotypic variance was calculated from the relationship, $\sigma_v^2 = \sigma_e^2 + r\sigma^2$ where σ_v^2, σ_e^2 are σ_g^2 are varietal, error and genotypic variances and r is the number of seasons. Phenotypic variance was computed as $\sigma_{..}^2 + \sigma_e^2$. Similarly, genotypic covariances were worked out from the equation $\sigma v_1 v_2 = \sigma e_1 e_2 + r\sigma g_1 g_2$ where $\sigma v_1 v_2$, $\sigma e_1 e_2$ and ffg^j are varietal, error and genotypic covariances respectively. The phenotypic covariances were calculated as ffg^j + $\sigma e_1 e_2$. The genotypic correlation coefficient between two characters was computed as the ratio of their genotypic covariance to the geometric mean of their genotypic variances. Phenotypic correlation coefficient was also similarly computed using phenotypic variances and covariance.

Results and Discussion

Genotypic and phenotypic correlation coefficients between all possible pairs of characters are provided in Table 1. These values, in general, are measures of degree of closeness of the linear relationship between pairs of variables. Genotypic correlation coefficient describes the inherent relationship between two variable

whereas this relationship is modified to certain extent *by* the environment in phenotypic correlation. General feature of the investigation is that genotyic correlation coefficients possess higher values for most pairs in comparison to their phenotypic correlation. This indicates that the strong inherent relationship between such characters is impeded by the influence of environmental factors. Johnson *et al.* (1955) also obtained higher values of genotypic correlations than phenotypic correlations between variables in soybean. Such relationship between characters was also obtained in pearl millet by Pokhriyal *et al.* (1967) and mung bean by Singh *et al.* (1968). Phenotypic correlation of spike length with number of berries per spike and spike yield clearly overestimate their actual relationship.

Table I

Phenotypic (P) and genotypic (G) correlation coefficients among various characters

Character		Spike length	100 berry weight	No. of berries per spike	Spike yield
Spike number	G	+0.034	—0.395**	—0.138	+ 0.850**
	P	+0.182	—0.201	+ 0.093	+ 0.833**
Spike length	G		—0.070	+0.398**	+0.366**
	P		—0.033	+ 0.639**	+ 0.466**
100 berry weight	G			—0.670**	—0.369**
	P			- 0.483**	-0220*
No. of berries per spike	G				+ 0.353**
	P				+0.338**

* Significant at $P < 0.05$

** Significant at $P < 0.01$

Among the various pairs of characters studied, the highest correlation (positive) was observed between spike number and spike yield, followed by berry weight and number of berries per spike (negative). Significant positive association (genotypic) was also found between spike length and number of berries per spike, spike length and yield; and number of berries per spike and yield. There was no relationship between three pairs of characters namely, spike number and spike length spike number and number of berries per spike; and spike length and berry weight.

On analyzing the genetic relationship of component characters with yield, it can be observed that all the components are positively and significantly correlated to the yield, except the berry weight which exerts a negative influence on yield. Further, it can be seen that berry weight is similarly associated with the two most important positive components namely spike number and number of berries per

spike. It is possible that this negative association of berry weight with aforementioned components, has resulted inthe similar ralationship with the yield also. Significant negative correlation between berry weight and spike yield will cause strong correlated response in one character in the undesirable direction, when selection is made for the other character. In pepper, berry weight (by virtue of its high degree of association with the boldness of berry) is a character of economic importance, since bigger berries fetch higher price for the produce. Hence, due weightage shall be placed on this component, while selecting high yielding genotypes.

Spike number acts independently of spike length and number of berries per spike to contribute to the yield. But its real contribution on the yield is seen enhanced to certain extent by the berry weight. Similarly, the contribution of spike length to the yield is independent of other components except the number of berries per spike which has caused some inflation in the value. Efforts to improve the component characters that are positively related to the yield viz., spike number, spike length and number of berries per spike, will bring about simultaneous improvement tn the yield also; and vice versa.

The significant association between the yield and its components as well as various pairs of component characters themselves can be advantageously employed in formulating breeding programmes. However, it must be borne in mind that the correlation coefficients discussed in this study refer to the total relationship between two variables at a time, wherein other variables are not controlled.

Summary

Data on 28 genotypes of pepper recorded for three seasons, at the Pepper Research Station, Panniyur was utilized to estimate genotypic and phenotypic correlation coefficients in certain quantitative characters in pepper. in general, the characters showed higher genotypic correlation as compared to phenotypic correlation. All the component characters except berry weight were found to be significantly and positively correlated with the yield. On the other hand, berry weight had significant negative association with the yield and other components except spike length. Such relationship observed between pairs of characters will be helpful in planning breeding programmes in this crop.

സംഗ്രഹം

പന്നിയൂർ കുരുമുളക് ഗവേഷണ കേന്ദ്രത്തിൽ നടത്തിയ പഠനത്തിൽ, കുരുമുള കിന്റെ വിവിധ സ്വഭാവങ്ങളും തമ്മിലുള്ള ജീനരൂപവും പ്രകടരൂപവുമായ പരസ്പര ബന്ധങ്ങളും ആവിഷ്കരിച്ചിരിക്കുന്നു. പൊതുവേ ജീനരൂപ പരസ്പര ബന്ധങ്ങളും, പ്രകടരൂപത്തിലുള്ളവയേക്കാളും കൂടുതലായി കണ്ടു. കുരുമുളക് മണിയുടെ ഭാരം ഒഴികെ

യുള്ള എല്ലാ ഘടകസ്വഭാവങ്ങളും വിളവുമായിട്ട് ധനാത്മബന്ധം ഉള്ളതായി കണ്ടു. അതേ സമയം കുരുമുളകുമണിയുടെ ഭാരം, തിരിയുടെ നീളം ഒഴികെയുള്ള എല്ലാ സ്വഭാവങ്ങളുമായിട്ട് ഋണാത്മകമായി ബന്ധപ്പെട്ടിരിക്കുന്നു. സ്വഭാവങ്ങളം തമ്മിലുള്ള ഈ പരസ്പര ബന്ധം കുരുമുളകിന്റെ പ്രജനനത്തിന് സഹായകമായി ഉപയോഗിക്കാവുന്നതാണ്.

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